Mars 2024 Pathfinder Mission Integrated Field Test

Completed Technology Project (2016 - 2018)

Project Introduction

Description of the Technology:

The purpose of this project is to test the hardware and software developed and integrated during the FY15 STMD GCD/IR&TD/CTC project called Mars 2024 Pathfinder Mission with complementary systems developed at other centers to produce an integrated system that would use water-containing regolith from a simulated martian planetary surface and carbon dioxide from simulated martian atmosphere to create 0.128 kg oxygen/hr. and 0.032 kg methane/hr. (a 4:1 mass ratio), liquefy the propellants, and use them to power a rocket thruster, thus proving that NASA can successfully produce an In Situ Resource Utilization (ISRU) end-to-end ("Dust-to-Thrust") system that will influence future Mars ISRU precursor payloads and human systems.

The existing project scope is to complete the design, fabrication and integration of the RASSOR Excavator, the Hopper Lift Regolith Feed System, the Dust Tolerant Automated Umbilical (DTAU), the Mock-Up Regolith Reactor, and the Atmospheric Processing Module (APM), which are the subsystems located at KSC, and integrate them onto the deck of the completed Mars Lander Mock-Up at KSC.

Anticipated Benefits

Value to NASA:

This project continues an evolutionary process to refine ISRU technology, increase confidence, and scale-up to crewed missions to Mars. Mars DRA 5.0 and the Evolvable Mars Campaign depend on ISRU as an enabling technology by reducing the Mars Ascent Vehicle mass as much as 30 metric tons. This reduction would eliminate at least two SLS launches and may be necessary to minimize the mass landed on Mars. The conceptual Mars 2024/6 Pathfinder Mission will demonstrate propellant production by an ISRU payload on Mars and our combined ISRU system ground test would be the initial step in refining the design and moving towards a flight ISRU system. Multiple copies of the ISRU units would be used to generate sufficient propellant for human missions. Similar ISRU hardware could be used at the lunar poles to convert lunar carbon monoxide into storable methane fuel using local water ice as a source of hydrogen and oxygen.

Value to the Nation:

Propellant made with ISRU technologies developed by NASA can be made in space and could become a commercial product which will kick start the space economy. Other ISRU technologies will then allow manufacturing in space which will also advance economic activity and human prosperity. Commercially, the ability to convert CO_2 into methane has a wide ranging

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Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Kennedy Space Center (KSC)

Responsible Program:

Center Independent Research & Development: KSC IRAD

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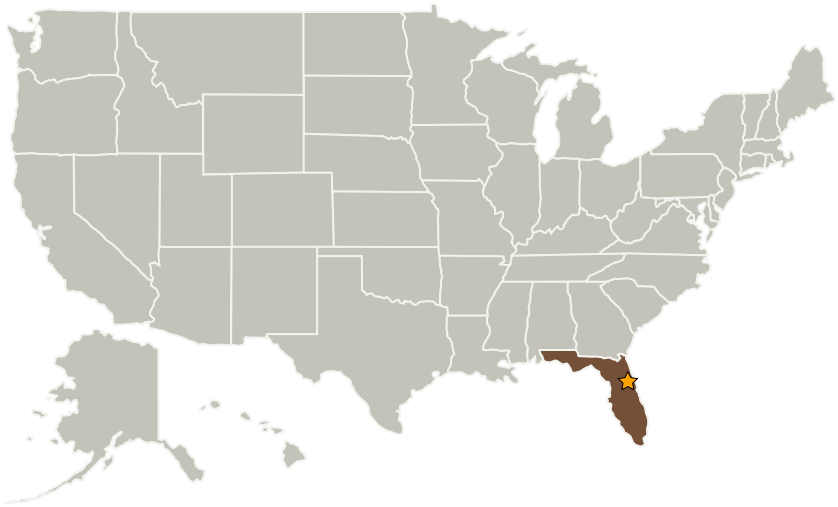
applicability as a green technology by converting CO_2 from chemical or power plants, or metabolic CO_2 from closed loop environmental life support systems into methane to be used as fuel or for power. On the Moon, ISRU systems could use in situ CO and water to provide propellant in LEO for commercial satellites and spacecraft.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida

Primary U.S. Work Locations
Florida

Project Management

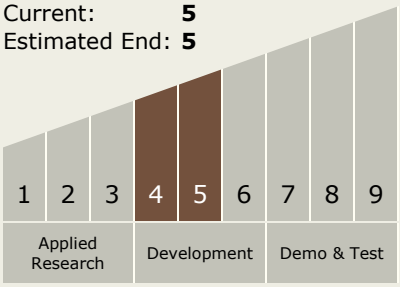
Program Manager:
Barbara L Brown

Project Manager:
Anthony C Muscatello

Principal Investigator:
Anthony C Muscatello

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.3 Resource Processing for Production of Mission Consumables

Target Destination

Mars